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MAR 19 1920

With regards of Herbert Osborn

E. L. Gen.

53,608.

ENTOMOLOGICAL PAPERS

FROM THE TRANSACTIONS OF THE

IOWA STATE HORTICULTURAL SOCIETY,

FOR THE YEAR 1882.

COMPRISING

PREMIUM ESSAYS BY HON. J. N. DIXON AND MISS ALICE B. WALTON, AND THE ANNUAL REPORT OF PROF. HERBERT OSBORN.

FOR GRATUITOUS CIRCULATION.

DES MOINES:
F. M. MILLS, STATE PRINTER.
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THURSDAY AFTERNOON SESSION.

The subject of Entomology was resumed.

DISCUSSION.

Mr. Guilford: I would like to say a word in regard to the arsenic remedy proposed by Mr. Dixon. If not too strong I am confident it will prove the most effectual insect exterminator yet tried. I was at one time so troubled with grubs in my ground that I could not start a strawberry patch. As fast as I put out the plants they were eaten off, I conquered the situation by dipping the roots in arsenic water before planting. Mr. Dixon cautions experimentors from inhaling the vapor from the arsenic water when boiling. I am confident there will be no danger from this source. I have worked in the shot manufactories and have been too much in the vapor thrown off by preparations of arsenic to be afraid of it.

Dr. Hinrichs: The kind of arsenic which Mr. Guilford has worked with in the shot towers is more to be feared than the white arsenic used by Mr. Dixon. While it is well to be reasonably careful there will not be much danger from the vapor passing off from the arsenic water while dissolving. This form of arsenic will not volatilize; so it must be safe in this respect. But Mr. Dixon's precautions relative to keeping stock from eating the grass on which the spray has fallen is surely well founded.

Mr. Guilford: We have men here in Dubuque who have spent much of their time for twenty years in rooms filled with a worse vapor from arsenic than can be given off from a tank of water in which white arscenic is dissolving. But these vapors are hard on insect life. Within half a mile of the shot tower here everything is let alone by the insects, even the cabbage worm forgets his mischievous habits in this circle.

Mr. Mead now introduced the following resolution:

WHEREAS, The Mississppi Valley Horticultural Society has advertised a meeting to be held in the city of New Orleans on the 20th of February, to which a cordial invitation is extended to all the lovers of fruit in the valley; therefore.

Resolved, That this Society appoint a delegate to attend this meeting, and

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report to this Society at our next annual meeting, and that our retiring president, Capt. C. L. Watrous, be appointed such delegate.

Motion passed.

The report of Professor Osborn on noxious insects was in order.

ENTOMOLOGICAL NOTES FOR THE YEAR 1882.

BY PROF. HERBERT OSBORN, AMES.

My observations for the past year have been distributed over a variety of insects, but in this report it may be best to confine myself more particularly to those of greatest importance to horticulturists. I will, therefore, simply make such extracts from my notes, and comments upon them, as may seem to me of interest or importance to the members of this Society.

Among the first observations of the season, and perhaps first in importance, are those upon the food habits of the *Thrips*, and their relation to the failure of fruit bloom. These were briefly noted in the *Iowa Homestead* of May 26, 1882. The importance of these little creatures is not at first apparent, but becomes so as soon as we consider the nature of their work.

It is a fact well known to intelligent fruit-growers that the fertilization of the germ in the fruit-blossom takes place through a slender style, and unless the connection between the stigma, or exposed end of the style, and the ovary is perfect no fertilization can take place, and no fruit can result.

In examining fruit-blossoms early in the spring for *Tortrix* and other pests, I was struck by the immense numbers of *Thrips*, that swarmed in nearly every blossom, and finding in many of these blossoms that the formation of fruit was already impossible, owing to the destruction of the style, it occurred to me that these little insects might be the cause of the injury, and this idea seemed confirmed by further observation; but in order to be as certain as possible of the correctness of this theory the following plan was adopted to secure the facts: A number of blossom buds which were still *unopened*, and

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hence certainly unfertilized, were collected at random from a number of trees and carefully examined. It was found that at least eighty per cent contained *Thrips* and had the styles more or less injured; in some the injury was not so great as to make fertilization impossible, and it would of course be difficult to determine at this stage in how many the injury had been so great as to cut off the communication between stigma and ovary. That there was serious injury to the styles, however, I can have no doubt; and the presence of the *Thrips* and the absence of other insects, or other agent that could produce the injury observed, leaves scarcely any chance for doubt that these were the authors of the mischief. In the same examination I found less than ten per cent of the buds contained the larvæ of *Tortrix,* so that for this locality, and the time the observation was made, it seems to me there can be no question as to the relative importance of the two insects.

It will, of course, be manifestly improper to reason from this observation that failure in fruit-bloom in general may be ascribed to this cause; but it seems to me a matter well worthy your encouragement and attention, and I trust that each member of this Society will make it a point to examine such orchards as he can, so that we may get results from a number of localities in different parts of the State.

Perhaps I should here state more fully the habits, appearance, and what is known of the life-history of the *Thrips.* The term has been frequently misapplied, and many different insects, entirely unlike the true *Thrips*, have been known to horticulturists and others under this name. As properly used it is applied to the family *Thripidæ*, by some authors called order *Thysanoptera*, which contains a number of subdivisions (genera) of which *Thrips* proper is one. Thus, while *Thrips* as a common name may be applied to all members of the family, technically it must be limited to one genus in the family.

All the species of the family are very minute in size, none that I have examined being more than one-sixteenth of an inch in length, while they are very slender, their bodies usually being no thicker than a fine needle. This enables them to crowd into very narrow places, as between the unopened petals of the apple blossom, and also accounts for their not being observed more frequently. Indeed, unless one notices particularly, they may be overlooked entirely. The wings are transparent and very delicately fringed and fold flat on the back when at rest. The mouth parts are peculiar in their structure and so adapted that they can pierce the tissues of plants and suck up the

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juices which they may reach, and while they might serve to prey upon animal food if stationary and soft, both the position and form would seem to preclude the idea of their preying upon active insects.

The prevailing color is black, but some species are yellow, and still other colors are occasionally noticed.

The young resemble the adults with the exception of lacking wings, and the transformations seem irregular, the young larvæ, pupæ, and adults being found together late in the season as well as in the spring. I have usually found the adults largely in excess of other stages, but the minute size of the young will in part account for this.

Their food habits have been variously interpreted by different authors. Westwood, in his "Classification of Insects," speaks of them as vegetable feeders, and gives examples where they have caused serious damage to crops. Dr. Fitch describes several species injurious to apples, wheat, and other plants. Mr. Walsh argued that they were carnivorous and occurred on plants and in blossoms in search of prey, while Prof. Riley mentions a species as feeding upon the grape phylloxera, It seems to me, however, that the burden of proof not only from observations but from the structure of the mouth parts is in favor of a vegetable diet, though exceptions may occur where a species becomes carnivorous.

P. S. In this connection I take the liberty to reproduce an article published in *Psyche* by Mr. Theo. Pergande of Washington, and which I have received since this report was presented.

"In a communication in *Psyche*, vol. 3, p. 369, Mr. Herbert Osborn gives some interesting observations on the habits of a certain undescribed species of Plœothrips which he found in abundance in all the fruit blossoms which he examined, stating that they were doing much damage to the tender styles by biting and puncturing them and preventing thereby the fertilization of the ovaries.

"Taking it for granted that *Thrips* really does all the damage ascribed to it, it remains as a rather singular fact that, notwithstanding the great abundance of *Thrips* in all kinds of flowers, the yield of good and numerous seeds is not materially diminished. I am therefore of opinion, that although the *Thrips* may somewhat injure the styles and other parts of the plants, they mainly gather the nectar which is more or less excreted, and while actively running about, assist in fertilizing, as more less of the pollen will adhere to their feet and body and doubtless will be carried to the stigma.

"That many species of *Thrips* are vegetable feeders, in some of their

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stages, has long been well known, and I have seen numerous species on all kinds and all parts of plants, and some of these *Thrips* I have seen in the act of feeding, but I have also observed that not all species have entirely the same habit, and that some in one stage or another are carnivorous. Especially have I noticed this to be the case with a species which is frequently found upon the leaves of *Platanus*, and upon other plants which are badly infested with *Tetranychus telarius*, upon the adult and young, and probably also upon the eggs, of which these *Thrips* feeds.

"It may also turn out that two or three species which swarm in great numbers in the blossoms of clover (which are usually full of the eggs and larvæ of *Cecidomyia leguminicola*), are partially carnivorous, and further observations may prove that they mainly search and feed upon the *Cecidomyia*.

"I may also mention here, that this year, as late as November 14, after several quite cold days, I found for the first time *Heliothrips hæmorrhoidalis*, Bouchè, on apple leaves in the orchard of the United States Department of Agriculture, as lively and active as in hot-houses, where this species was only observed previously.

"I may also mention the presence of *Heliothrips dracænæ*, Heg., in the conservatory of the Department of Agriculture, an insect which is reported as doing immense damage to *dracænas* in hot-houses in different parts of Europe.

"THEODOR PERGANDE.

"*Washington, D. C., November 15, 1882.*"

As Mr. Pergande has been making a special study of this group of insects for some years his opinion upon this point is of great value.

His statement concerning the nectar-feeding habits of some *Thrips* will serve to explain the presence of these insects in some kinds of blossoms where no injury can be detected, nor insects upon which they could feed.

The small yellow *Thrips* (not a *Phlœothrips* as erroneously stated in *Psyche*), which I noticed in apple and cherry blossoms, I have also observed in the blossoms of wild roses, asparagus, catalpa, potato, clover, pansy, wild sunflower, and milkweed, and in none of these, except potato, did I observe any injury to the blossoms, nor could I detect any indications of other insects upon which they could feed. In the milkweed blossoms they were observed with care, and the following entry made in my note-book under date of August 14, 1882: On *Asclepias* found yellow *Thrips* plenty, also a small *Dipter*, feeding on

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honey or other secretion. Afterward, I placed some of these blossoms in a glass tube, and watched their actions. *Dipters* all traveled toward the light (of a window). *Thrips* paid less attention to it. Could see *Thrips* set the mouth parts down upon the surface of the blossom, much as a fly does in lapping up sugar, sometimes forcing it down, but I could not discover any puncture. They avoided the *Dipters*, and ran away if one came near enough to touch.

In clover, these and a black species of *Phlœothrips* occurred together, and I occasionally found a red mite in the same blossoms, but very rare as compared with the *Thrips*, and I saw no indications whatever of *Cecidomyia*. In timothy heads I found (July 12th) a peculiar black species of *Heliothrips* quite abundant, but confined to the young heads, or those just in bloom, and not to be found in the riper ones. No signs of other insects could be found, and careful watching with a lens gave me no clue to the food of the *Thrips*. In potato blossoms, observed at Manchester July 10, the styles were in some cases injured slightly, but it may have been by some other insect not then to be found.

It seems to me that if it is permissible to draw any conclusion upon this subject, it is that while the thrips have diversified food habits they are capable, as in the case of apple blossoms, of causing serious injury, and form a factor not to be neglected in the problem of failure in fruit bloom.

BARK-LICE.

During the year my attention has been frequently called to this injurious group of insects, and as they are among our most constant and serious pests, they well deserve a passing notice.

The Maple Bark-louse (Pulvinaria innumerabilis) was observed in Davenport early in July, and a little later I received specimens from Hon. Geo. H. Wright, of Sioux City, with the statement that their numbers there were causing considerable alarm.

They were very abundant in the city of Davenport a few years since, where their habits andli fe-history were very carefully studied by the lamented J. Duncan Putnam, whose researches in entomology had won for him deserved distinction. To his valuable essay upon this insect I am largely indebted for what knowledge I have of its habits.

Its natural food plant is as its name indicates, the maple, and it flourishes particularly upon the soft maple. It occurs also on box-elder, linden, sugar maple, locust, grape, sumac, and other plants.

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It is most noticeable during July, when the large white cottony nests, which contain the eggs, are seen fastened to the twigs and branches of the tree. These nests, which are formed by the adult female, the brown scale of which is seen at one end of the mass, contain a large number of eggs, which hatch usually during July. The young larvæ, which are small whitish specks, are very active and begin traveling in all directions over the twigs and leaves. They soon fasten themselves by their sucking tubes, usually to the leaves, and commence feeding upon the juices of the plant; a waxy scale is formed over each one and they become full grown in a few weeks.

The males live but a short time, but the females migrate from the leaves in the fall and fasten themselves to the twigs, where they remain during the winter, well protected by their waxy scale. In the spring their bodies rapidly increase in size from the development of eggs, and in May they begin to form the nests of eggs which become so conspicuous by the first of July, and from which the larvæ of the coming generation are hatched shortly after. The natural parasites are numerous, and these seem to have almost entirely overcome the pest in Davenport, for during my short stay there I could find only a few trees infested with them, and these had so few lice upon them that they would not be noticed unless searched for.

Mr. Putnam enumerates eight species of parasites, the most valuable of which are probably the lady birds (small hemispherical beetles, *Coccinellidæ*, common in every locality), and a hymenopterous insect (*Coccophagus lecanii*) which preys internally upon the lice. The encouragement of these parasites is one of the most important points in fighting this pest, that is, to put no obstruction upon their multiplication. Some people who do not understand the habits of the lady birds, are very careful to destroy them, thinking them injurious, and as they are easily captured much harm may be done in the belief that a serious pest is being destroyed.

If the natural enemies of the insect are not at work, artificial remedies must be resorted to. One that has been used with good success in some places is to charge an ordinary "fire extinguisher" in the usual way with bicarbonate of soda and sulphuric acid, then add to the water used one spoonful of carbolic acid to every eight gallons of water, or perhaps better still, use kerosene instead of carbolic acid. The force from the extinguisher will be sufficient to carry the fluid to all parts of the tree. This will of course be most effectual if applied

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while the larvæ are still very young, before they are protected by a scale.

Where the use of the fire extinguisher is impracticable the use of kerosene, soap, or lye should be resorted to, and the details for using these will be stated more fully in giving remedies for bark lice in general.

The "heading in" process is said to be quite effectual, and where the effect upon the appearance of the tree is not a consideration, may be recommended. This consists in removing all but the trunk and a few main branches of the tree. As the insects confine themselves to the outer, smaller branches, it is not difficult to destroy nearly all in this way, and if any remain on the parts that it is desirable to save, they may be cleaned off by washing with solution of soap, or the kerosene emulsion. This remedy is said to be most effectual if the "heading in" is done in early summer.

Care should be taken in districts where this insect is not introduced, that it does not get started, and if it appears, vigorous measures should at once be adopted to prevent its spreading and gaining a foothold, for when it gets established it is extremely difficult to eradicate. The fact that it subsists upon such a variety of plants enables it to spread and multiply rapidly in almost any locality.

The Scurfy Bark-louse (Chionaspis furfurus)—In my previous reports to this Society, where this insect has been mentioned, it has been referred to as of secondary importance and not likely to need attention from the orchardist, but the past year's experience has changed this opinion. In fact we cannot tell when obscure insects of little importance may from some slight change of conditions multiply excessively and become serious pests.

This insect has generally been known as the Harris bark-louse (*C. Harrisii*), but as it was first described by Dr. Fitch under the above name, that should be retained.

In October I received specimens of this bark louse from Mr. C. Ogburn of Madison county, with the information that his trees were "completely covered with them," and the specimens he sent would indicate that he did not exaggerate any in his statement. In an orchard in Ames I saw some trees that were very seriously infested, and I found them quite abundant upon black walnut, wild cherry, and elm trees near town. A few were also noticed on different trees in Davenport. While I have not had oppurtunity to look for them particularly in other localities, it is quite likely they will be found to be on the increase and may soon cause serious injury.

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The scales of the female are irregularly rounded in shape, nearly flat, and of a grayish color. The scales of the males, which are very conspicuous if abundant late in the fall, are much smaller, slender, glistening white, and usually with three ridges above. They resemble, and are sometimes mistaken for, minute eggs. If examined, however, in October or November, they will be found empty, the male having emerged.

An examination of the female scale will reveal either the insect gorged with eggs, or else its dried and shrunken body with a mass of red or purplish-red eggs, these being deposited sometime during October, to remain under the scale over winter, while the female dies.

The eggs hatch about the first of June and the young spread rapidly over the twigs and branches, insert their beaks into the bark, and are soon protected by the formation of the scale over their bodies. They become mature in early fall, the males issue in the winged form which enables them to find the females, these latter never acquiring wings, but remaining inactive under their scales, which have been their shelter almost from the time of their birth.

Some of the specimens found upon elm seemed to differ from typical specimens taken from apple twigs, but still they are probably the same species.

The Oyster-shell Bark-louse (Mytilaspis pomorum) is well known and fortunately seems on the decline. Its ranks have been greatly depleted by the attacks of the little mite *(Acarus malus)*, which has been several times mentioned in the reports of this Society.

For the benefit of those who have not seen previous reports we will briefly recapitulate the habits of this species. Like the scurfy louse the eggs hatch early in June, and the lice mature early in fall, the scale which protects them is waxy in appearance, of a brownish color, and shaped like an oyster shell. The eggs found under the female scales late in fall and during winter are whitish instead of red in color, and it is upon these that the mites feed.

The mites are not more than half as large as the eggs upon which they feed, and though scarcely visible to the naked eye, can be readily seen with the aid of a small hand lens. Besides the difference in size they may be distinguished from the young lice by their having eight legs instead of six, and the bodies are more slender. Whenever a tree becomes infested with this louse, an examination of a number of scales on different twigs should be made, to determine whether mites are present or not, for if they are other remedies may be dispensed with,

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but in case no mites or other enemies are found, some of the remedies given should be vigorously applied or serious loss may result.

Last summer I noticed in an orchard, near Ames, several trees containing these lice, though not in serious numbers. They were also present in small numbers upon scattered trees in one orchard that I visited in Davenport, and Mr. Ogburn sent me a few specimens from Madison county.

The Willow Bark louse (*Chionaspis salicis*). This species is found in moderate numbers in the vicinity of Ames, and I collected specimens of a species very similar, if not the same, from poplar trees at Davenport.

The scale is snowy white, about one-eighth of an inch in length, and specimens examined October 12th disclosed the large gravid females, which are of a dark reddish color. A slight pressure would cause the eggs to be discharged, and in some specimens the deposition of eggs had begun at this date.

The eggs probably hatch at about the same time as those of the preceding species, and hence the best time of applying remedies where these become necessary would correspond with those.

The Oleander Scale (*Aspidiotus nerii*) occurs, as the name indicates, upon the oleander, and is a serious green-house pest. Specimens received from Mr. R. L. Blair, of Des Moines, October 20th, showed all stages of development from larva to adult. The scales are round and white, and nearly one-sixteenth of an inch in diameter, in the adult female. They are distributed thickly over both leaves and twigs, and as they multiply almost continuously it is evident that they must receive careful attention to prevent them from entirely destroying the plants upon which they live.

The Oval Scale (*Lecanium hesperidum*) occurs upon a number of green-house plants, and frequently infests the house plants which so many people prize as ornaments in their windows. I have noticed this scale upon oleander, periwinkle, ivy, etc., but it does not attack the plants with hairy bark, such as geraniums. I have seen them on neglected oleanders so thick as to hide the twig upon which they clustered, and in some places even piled up several layers deep. The effect upon the plant can easily be imagined. Like the preceding species, they seem to multiply continuously. I have observed newly hatched larvæ on periwinkle in midwinter.

The scales are brownish, waxy, oval and slightly convex in form, and about an eighth of an inch in length when the insect becomes adult.

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Besides these two, I have found on green-house plants a large, very convex, somewhat irregular, brownish scale (apparently a *Lecanium*), occuring on several varieties of plants, and a small, round, flattened, white scale (belonging to *Diapis*) on night-blooming cactus, both of which I have failed to harmonize with descriptions of known species.

I have sometimes been questioned concerning the scales which are so frequently noticed upon the oranges and lemons sold in the market. The one commonly noticed is the *citron scale* (*Mytilaspis citricola*), and it is common upon leaves, twigs, and fruit of oranges, lemons, and citrons in localities where these plants flourish. Their collecting upon the fruit is, in some cases, self destructive, since they do not meet with plants upon which they can live in many places to which these fruits are shipped.

Having now briefly mentioned the more common and important species of bark-lice, which will be met with in almost every locality, let us consider the

REMEDIES FOR BARK-LICE.

The natural insect enemies for bark-lice are quite numerous and do a great deal toward preventing their increase, but where these are insufficient and the lice multiply excessively, artificial remedies must be promptly adopted. One of the most valuable of these, if not the best, when properly applied, is

Kerosene. This has been often recommended but owing to improper use it has sometimes caused such injury to plants as to fall into disfavor.

Diluting it with water by means of emulsions with milk has been found by Prof. Riley and others to prove eminently successful, and since it seems to me of so much importance and as the proper methods of emulsion are so necessary, I take the liberty to extract from the report by Mr. H. G. Hubbard to Prof. Riley, published in the Report of the Commissioner of Agriculture for 1881-82, pp. 112—123, the details of forming such emulsions.

* * "The process of forming a perfectly stable emulsion of Kerosene and milk is comparable to that of ordinary butter making, and is as follows: The oil and milk in any desired proportion are poured together and very violently dashed or churned for a period of time ranging with the temperature from fifteen to forty-five minutes The churning, however, requires to be much more violent than can be effected with an ordinary butter churn.

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"The Aquapult force pump, which is also the most effective instrument I have seen for spraying orange trees, may be satisfactorily used for this purpose when moderate quantities only are required. The pump should be inserted in a pail or tub containing the liquids, which are then forced into union by continuous pumping back into the same receptacle through the flexible hose and spray-nozzle. After passing once or twice through this pump the liquids unite and form a creamy emulsion, in which finely divided particles of oil can plainly be detected. This is as far as the process can be carried by stirring or by dashing in an ordinary churn; the product at this point will not bear diluting with water and separates or rises at once to the surface. On continued churning through the pump the liquid finally curdles and suddenly thickens to form a white and glistening butter perfectly homogeneous in texture and stable.

"The whole amount of both ingredients solidify together, and there is no whey or other residue. If, however, the quantity of the mixture is greater than can be kept in constant agitation, a portion of the oil is apt to separate at the moment of emulsification, and will require the addition of a few ounces of milk and further churning for its reduction.

"This kerosene butter mixes readily in water, care being taken to thin it first with a small quantity of the liquid. The time required to bring the butter varies with the temperature. At sixty degrees Farenheit, it is half to three-quarters of an hour; at seventy-five degrees, fifteen minutes; and the process may be still further facilitated by heating the milk up to, but not past, the boiling point. Either fresh or sour milk may be used, and the latter is even preferable.

"The presence of kerosene does not prevent or hinder the fermentation of the milk. On standing a day or two the milk curdles, and although there is no separation of the oil, the emulsion thickens and hardens and requires to be stirred, but not churned, until it regains its former smoothness.

"If sour milk is used no further fermentation takes place, and if not exposed to the air, the kerosene butter can be kept unchanged for any length of time. Exposure to the air not only permits the evaporation of the oil but also of the water necessary to hold the oil in emulsion; the kerosene slowly separates as the emulsion dries up and hardens.

* * * "As the result of numerous experiments, I would recom-

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mend an emulsion consisting of refined kerosene, two parts; fresh or (preferably) sour cow's milk, one part (percentage of oil 66⅔). * *

"In applications for scale insects, the kerosene butter should be diluted with water from twelve to sixteen times. * * * The diluted wash resembles fresh milk, and if allowed to stand, in two or three hours the emulsion rises as a cream to the surface. The butter should, therefore, be diluted only as needed for immediate use, and the mixture should be stirred from time to time.

"The great difficulty experienced in reaching every part of the tree renders it absolutely necessary that any liquid used should be applied in fine spray and with considerable force. An ordinary garden syringe does not accomplish this and can never be used satisfactorily against scale insects. The most effectual instrument known to me is the aquapult force pump. This throws a constant stream of moderately fine spray with such force that the fluid is driven into close contact with the bark, and on striking the leaves and branches is dashed into fine mist, which envelops the tree and wets every leaf. The tree should always be sprayed from each of four sides, and rather more liquid should be used than seems necessary to drench every portion."

The full report contains detailed accounts of Mr. Hubbard's experiments with different solutions upon different kinds of scales, besides much other interesting and valuable matter, but these extracts may enable any one to get upon the right track when they can modify the methods of application, etc., as occasion may demand, while those who desire to investigate the matter fully should procure a copy of the report through their congressman in Washington.

I may here add that I have lately seen the statement that Prof. Forbes, State entomologist of Illinois, has found this kerosene emulsion a successful remedy for chinch bugs, the mixture he used costing but half a cent per gallon.

Whale oil soap is quite highly recommended by Prof. Comstock and others as a remedy for bark lice, and while it does not destroy the eggs or penetrate the scales after they are well formed, there can be no question as to its value in destroying the young lice, and for species where the time of hatching is well marked, so that the application can be made when they are but slightly, if at all, protected, it can be used to great advantage. A solution consisting of one-fourth of a pound of soap to a gallon of water should be thoroughly sprayed over the trees. Small plants can be washed with the solution if more convenient.

Concentrated lye in solution of one pound of lye to a gallon of

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water is highly recommended by some to be applied before the buds open in spring. Others have been quite unsuccessful in its use and whether those who urge its value have been deceived by the lice dying from other causes or whether the others have not used it properly I am not prepared to state.

MISCELLANEOUS NOTES.

Cabbage butterflies were quite numerous in Ames late in the season. Besides the common species which are usually observed, a species known as the *zebra caterpillar* (*Mamestra picta*) did some little damage in Ames. The caterpillars are yellow, marked with numerous zigzag black lines. They feed gregariously while young, but scatter over the plants as they become older. It is, therefore, easy to destroy them if they are noticed when they begin work, by simply picking off the leaf, or portion of the leaf, upon which they are clustered. They feed upon cabbage, cauliflower, and other plants belonging to the same group, and are double brooded.

Strawberry worms—The larvæ of the strawberry saw-fly (*Emphytus maculatus*) were quite abundant. A few tests to determine the comparative value of London purple and hellebore showed that the London purple was much more effectual, and being much the cheaper is certainly preferable where it can be applied. It would of course be unsafe to use it where the fruit is ripening and it is intended to be gathered. On new beds or at other seasons it may be depended upon as effectual, and by using thoroughly on the fall brood the insect can be subdued.

Allied to this insect, though differing in appearance as larvæ, is the *Cherry slug* (*Selandria cerasi*) which did some injury to cherry trees in Ames last September. The slugs are blackish and shiny, largest near the head and tapering backward. There are two broods in a season the first appearing in June, the second in September. They enter the ground to transform, those of the second brood passing the winter as chrysalids and appearing as glossy black saw-flies in the following spring.

Although I have not tested it, I am confident that London purple will prove certain death to this as to all of these saw-fly larvæ, rose slugs, willow worms, etc This leads me to say that for a great many insects that devour the leaves of plants, I know of no more simple cheap and effective insecticide to recommend for general use, to people especially

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who do not wish to take the pains required in dissolving and properly diluting arsenic.

Pyrethrum powder is becoming quite well known as a remedy for some very injurious insects, and on account of its safety to animal life, and effective operation on insects, it will no doubt supersede most other remedies as soon as its cultivation becomes general enough to bring the price within limits that render it profitable to use.

DISCUSSION.

Mr. Dixon: I would like to ask a question relative to the composition of the London purple. What poisonous element is in it, making it effectual in the destruction of insects.

Prof. Osborn: It is said to be the waste material in the manufacture of the analyne dyes. The destructive element is supposed to be arsenic. I do not know the exact per centage of arsenic found in the commercial article.

Dr. Hinrichs: My observations agree with those of the Professor. It is a waste product containing a small per cent of arsenic. Just why we should use arsenic in this form I cannot guess. I suspect, too, that the per cent of arsenic varies in this waste material which is sent to us by our wide awake English friends across the ocean. The white arsenic is a fixed and positive substance. We can every time determine the real strength of the solution we use for drenching our trees or plants. The color of the London purple amounts to nothing. We know where we put the poison, and as Mr. Dixon says, we must take care not to turn the cattle in the inclosure where it is used, until after a rainfall.

Professor Osborn: Mr Dixon says that the arsenic water will probably prove destructive to the chinch bug. In this case we must destroy the insects in a way quite different. The canker worm is poisoned by eating the foliage. The chinch bug has only a sucking apparatus. Professor Forbes states that a solution of kerosene will best answer the purpose. Kerosene in the proper proportion with milk and water is the best thing known for the destruction of bark lice on apple trees. It mixes readily with an equal quantity of the milk, water, and kerosene. This composition will penetrate the scales and destroy the contents.

Mr. Dixon: Have we any work in this country on the thrips and their injury to blossoms.

Professor Osborn: I think not. An English work on entomology

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by Dr. Westwood gives much valuable information in regard to their habits. I have found the thrips in the blossoms of nearly all plants through the season. They were especially numerous in catalpa blossoms.

Dr. Hinrichs: Have you any positive evidence that these little mites are injurious to our fruit tree or other blossoms?

Professor Osborn: As stated in my paper I have found the styles of numbers of blossoms injured under circumstances making it very evident that the thrips had caused the mischief.

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